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Tree Species are influenced by Small-scale Topographical Heterogeneity

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Editorial

The partitioning of precipitation into interception, throughfall, and stem flow by forested ecosystems has an influence on terrestrial water and nutrient budgets. Physiological and morphological features linked to forest composition, seasonality and the presence/absence of leaf, precipitation parameters, and climatic circumstances all influence how water is partitioned into these three channels. As a result of the wash off of dry deposits that accumulated during previous dry times, these routes may become richer in nutrients and other solutes.

The varied canopy cover causes the spatial diversity in through fall hydrology. Physiological characteristics including stand density, crown cover %, and leaf area index, which contribute to autumn variability, may cause variation in canopy density. Through fall, Crown features and rainfall factors interacted in tropical plantations, resulting in interspecific variances in through fall partitioning among four commercially cultivated tree species. Intra- and interspecific changes in canopy density, such as the contribution of branch drainage to throughfall production at higher stand densities, were seen to impact variability in a natural mixed-deciduous stand.

Spatial variability is caused by physical factors such as distance from the stem at even smaller scales within a single canopy; however it is unclear if this variability is systematic. However, at certain sites beneath a leafed canopy, throughfall variability has been proven to remain stable over storm episodes. As a result, to properly measure the hydrologic flow to the forest floor, throughfall monitoring necessitates close attention to stand features and tree dynamics. The distribution of water resources over the environment is influenced by topography as well. Higher elevation stands, especially those above the typical cloud base, might generate more total volumetric throughfall through cloud water condensation, potentially increasing total solute flow.

In forested ecosystems, the presence of tree canopies causes a sudden increase in surface roughness, which introduces frictional drag to horizontal air flow, resulting in enhanced deposition of airborne gases and sediments on foliar and woody surfaces. This feature, together with the greater capacity for atmospheric deposition caused by the complex geometries of leaf surfaces, gives forest canopies superior scavenging capacities and preferential access to passing air masses. Differences in throughfall biogeochemistry between uplands and floodplains are less noticeable at lower altitudes, especially when studies are designed to monitor forest communities with similar species composition in both landscape locations.

The catchment aspect, on the other hand, has been demonstrated to alter throughfall partitioning, with slopes towards impending storms receiving more precipitation, resulting in larger overall throughfall. The effects of topography, elevation, and aspect on throughfall variations are visible at extremely broad geographical scales. Differences in these elements, however, might generate microclimate conditions that give competitive advantages for certain species within relatively narrow catchments.

Short variations in elevation and slope direction can cause differences in species composition over small geographic gradients, making understory light and moisture conditions more suitable for regeneration and establishment of particular species. As a result of these microclimate circumstances, forest canopies with predictable species assemblages emerge, influencing throughfall hydrology and nutrient flow in distinct ways even over modest topographic gradients. Individual outliers stemming from random seed dispersal methods are always present, but microclimate variables have the greatest impact on competitive dynamics overall.

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